Mr. Robert Ellis' compound inhalers for anaesthesia by mixed vapours, manufactured only by Messrs. Savigny & Co., 67, St. James's Street.

MR. ROBERT ELLIS'

COMPOUND INHALERS,

FOR

ANÆSTHESIA,

BY MIXED VAPOURS.

MANUFACTURED ONLY BY

Messrs. SAVIGNY & Co., 67, St. James's Street.

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THE

COMPOUND INHALERS

FOR

"ANÆSTHESIA BY MIXED VAPOURS."

THE principles of the new system of Anæsthesia introduced by Mr. Robert Ellis, under the above title, are perfectly carried out in the construction of the Inhalers described in this paper. These are thus stated in his recent work on the 'Safe Abolition of Pain.'*

First. Entire security against the excessive action of either of the anæsthetics.

Secondly. The production of a modified anæsthesia, *varying at the will of the operator*, from a mere feeling of exhilaration to the deep unconsciousness requisite for abolishing acute pain.

Thirdly. The power of maintaining this state of anæsthesia at the same degree for any requisite period, or of modifying it according to arising exigencies.

Fourthly. The reduction of the dose of chloroform to its lowest practicable point.

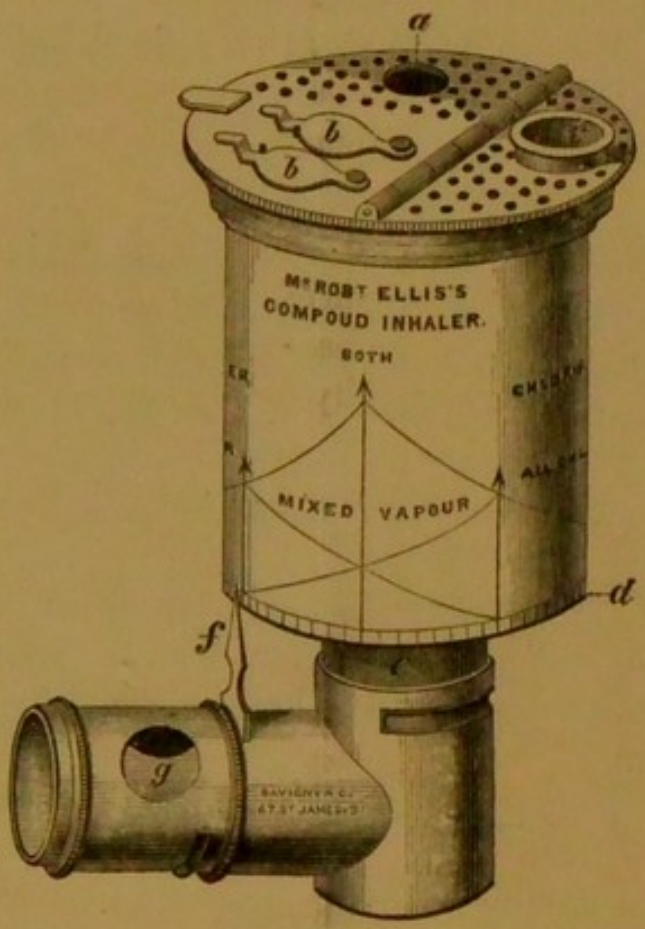
Fifthly. The partial substitution for it of a vaporous basis of mixed alcohol and ether, whereby its properties are enhanced and sustained, and its dose diminished without abatement of its value as an anæsthetic.

Sixthly. The counteraction of the heart-depressing power of chloroform, by combining it with a heart-stimulant, and

* 'On the Safe Abolition of Pain in Labour and Surgical Operations.' Robert Hardwicke, 192, Piccadilly.

thus obviating some of the most frequent causes of danger in chloroformization.

The instruments are of two kinds—one for surgical operations and intended to be held in the surgeon's hand; the other and more perfect form being adapted both for the operating room, and for the use of the accoucheur. The first kind is represented in the annexed cut.

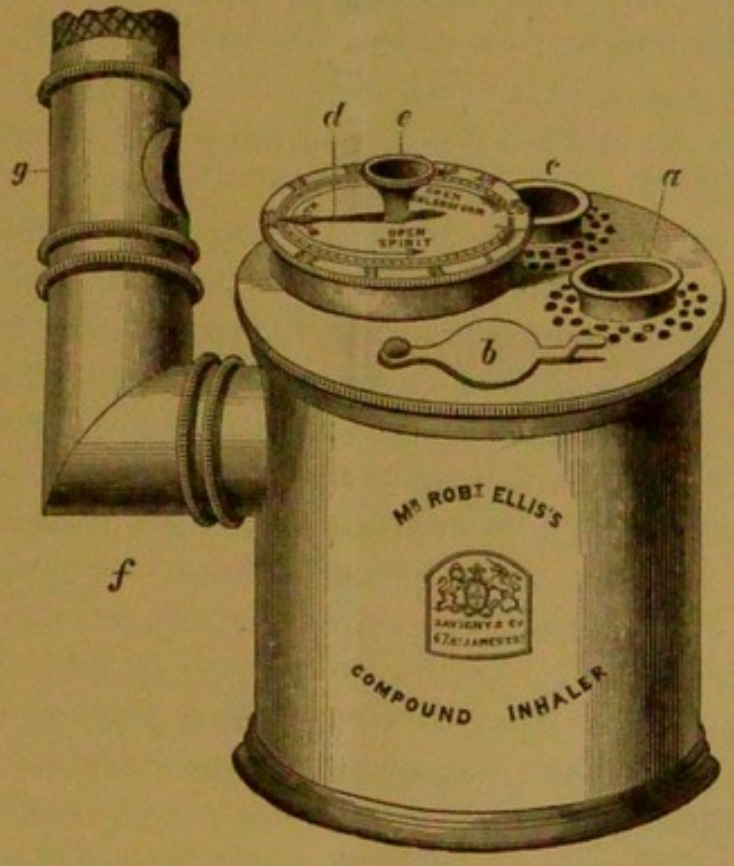


It consists of a movable reservoir *d*, divided into several compartments *a*, *b*, *c*, in which the different anæsthetic fluids are evaporated. Two-thirds of the space are devoted to the alcohol and ether chambers *a*, *b*, and the remaining third to the chloroform *c*. The reservoir makes a half-turn in its socket *e*, and thus brings in succession certain openings at the bottom of the apparatus leading to the one or other of these compartments opposite to the index finger *f*, and aperture of egress. Thus, by simply turning it either to the right or to the left, any degree of mixture can be given to the vapours,

and as much or as little chloroform may be administered as may be thought expedient. The rising lines on the side of the reservoir represent exactly the increasing proportion of either one vapour or the other. In addition there is an air-valve *g* in the arm of the apparatus which admits any requisite amount of air, either at the commencement or at any time during the process of inhalation. This instrument is best adapted for inducing insensibility during a surgical operation. It is charged with anæsthetic fluids through the apertures represented in the lid of the instrument.

The other apparatus is thus described by Mr. Ellis in the work alluded to:—

"My object having been chiefly to get a good arrangement for use in the lying-in chamber, I have devised the following instrument, which has been made for me by Messrs. Savigny, and has proved really invaluable. It is represented in the woodcut.



"It consists of a metal cylinder about three inches in height

by two-and-three-quarter inches in diameter. On one side, near the upper part, the tube *f* emerges which conveys the vaporized air from the chambers contained in the cylinder. This elbow tube has attached to it the valve *g* for admitting air at the commencement of the process, and it is movable so as to adapt itself to the different positions of the patient. Penetrating the cylinder, it communicates with a small circular chamber, at the bottom of which are two apertures, one connected with the chloroform side *c*, and the other with the alcohol *a* and ether *b*. The different currents of air charged with vapours are thus caused to come together at the bottom of this chamber, and the openings in it are covered by a circular valve perforated in one-half, so as to correspond with these openings, the other half being left blank. A little consideration will show the reader that if this flat plate be turned by a pin passing through its centre, it will, according to the direction of the rotation given to it by the pin, uncover either one or other of the openings, and at one part of its course both will be open simultaneously. Also that any degree of one opening may be uncovered or any degree of the other, according as the pin is turned more or less round. For example, all the alcohol and ether opening may be uncovered without uncovering that leading to the chloroform at all; or, turned a little more, *that* opening may be slightly, or more, or wide opened, at the will of the operator. Thus, by a most simple mechanical arrangement, we can procure any kind of mixture of the different vapours in any required degree, or beginning with chloroform only, that aperture may be kept alone in use. It is, in fact, difficult to express the remarkable facility for graduating the vaporized air in either one, or the direction which this adjustment affords.

"This pin is attached at its upper end to the index finger *d*, and is worked by a small thumb screw *e*. The upper end of this small cylindrical chamber being covered with a metal cap, the index finger lies outside, and on the surface of the cap is engraved a scale precisely corresponding to the

rotation of the valve beneath. The surgeon thus sees on this dial, as on the face of a watch, the precise condition of the valve below, and learns from it at a glance what is the nature and quantity of the vapour he is administering to his patient. Only an accident of some very extraordinary kind, or the most gross negligence, could interfere with the working of this index; and such is the arrangement for evaporation, that even in such an event, an overdose is as impossible as is the explosion of gas by the locked safety-lamp of the miner.

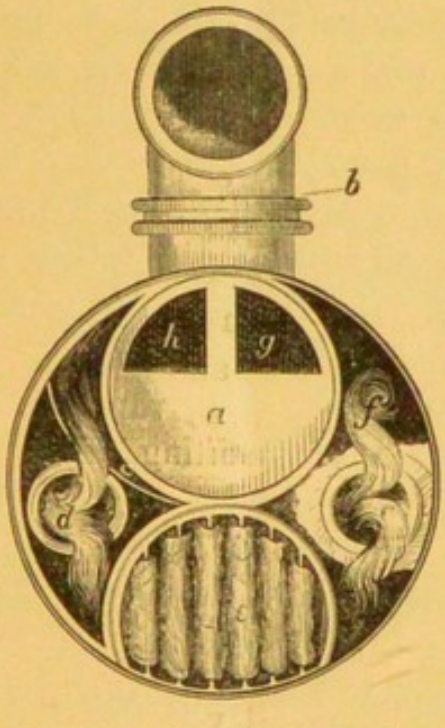
"The surface of the dial represents the gradual increase of aperture below, and is divided into equal divisions of five degrees each. I commence inhalation with the index pointing at five degrees of alcohol and ether, the receptacles for these fluids having been previously charged and the air valve in the elbow is then wide open. After a few inspirations this valve is gradually closed, and the index finger is advanced by single degrees up to ten. This is the point where chloroform influence faintly commences. The index is now moved *still more gradually* until it marks seventeen or eighteen degrees on the scale. Of these degrees, ten represent the mixed vapour of alcohol and ether, and the remainder that of chloroform. I very seldom find it necessary to advance the index farther than this point in a confinement; but for a surgical operation it will perhaps be necessary to go beyond it, and to give the vapour uninterruptedly from both sides of the apparatus, or if very deep anæsthesia be demanded, then the index must be taken a full half-turn onward, so as to give the predominance to the chloroform, and render the alcohol and ether mere auxiliaries. It is satisfactory to know that it is but seldom that the full power of the apparatus is really required, and it is a great relief to feel assured that at no point is it capable of giving a dangerous dose to the patient. At a point opposite to the elbow is a small space marked 'off,' indicating that when the finger is at that point, no vapour whatever can leave the apparatus. Thus it can be turned off in the intermissions of inspiration, and the waste of the fluids prevented.

"It will be seen that from its shape this instrument stands with perfect security, even on an irregular surface. It is therefore excellently adapted for the accoucheur. In my own practice, it is connected with an elastic tube to the other end of which the face-piece is fixed: the inhaler thus stands by my side, and all its arrangements are within easy and convenient control. But it may also be held in the hand, dispensing with the elastic tube, and directly fixing it on to the face-piece. It is in this condition more handy for use in a surgical operation."

The chambers for all three fluids are in this, as in the former arrangement, quite distinct; but those of alcohol and ether communicate with each other at one point. The fluids are supplied by pouring in a measured quantity, generally about 40 minims of each, through each of the funnel-shaped openings in the lid of the instrument. The aperture for supplying the ether is, in consequence of its excessive volatility, kept covered with a shifting metal plate, which is turned aside when the ether is poured in. The chloroform and ether chambers contain the small reservoirs, more particularly described below, and as these exactly underlie openings in the lid, it is easy to fill them from time to time as they require it.

The accompanying woodcut represents a section of this apparatus—*b* shows the elbow tube through which the vaporized air leaves the instrument. The circular chamber in which the vapours are assembled and mix, is seen at *a;* and *g* and *h* represent severally the apertures leading to the chloroform and to the alcohol and ether. The letter *c* shows the small glass-tube reservoir for chloroform, from which emerge the strands of cotton wick *f*,—one of the most beautiful parts of this invention. For it has been proved by Mr. Ellis, that a complete power of control over the quantity of chloroform liberated in the inhaler can be obtained by varying the number of the strands of wick employed—and these are, in this apparatus, adjusted so that, by simple capillary attraction, it is withdrawn minim by

minim in an exact and equal ratio, so as never to permit of a higher saturation with chloroform than from two to three per cent. in the inspired air. In this new system of compound anæsthetics this amount has been found quite sufficient for perfect insensibility to pain, and experiment has proved it to be absolutely safe. At *d* a similar arrangement governs the escape of the ether. The semi-circular chamber *e* is occupied by an entirely new arrangement, devised by Mr. Ellis, for the evaporation of the alcohol. As shown in the cut, this consists of a framework of vertical folds of cambric, over which the alcohol falls, and saturates the air drawn through them in the most complete and perfect manner.



Thus, by a simple adaption of the law of capillary attraction, the inhaler is only capable of evaporating a certain definite dose of chloroform or ether, so that absolute security is thereby obtained against an overdose, in addition to the valuable protection of the regulator valve. While, on the other hand, by the remarkable contrivance for the evaporation of the alcohol, it is possible to communicate any required quantity of this powerfully stimulant vapour to the inspired air. The instruments are perfectly self-acting, and, when

once arranged for use by the makers, require little if any further attention for a considerable time. If, however, it becomes necessary to cleanse them, the lid may be easily removed and fresh material introduced. In order to ensure uniformity of action it will be necessary to take care that the *same number* of strands of wick is employed as when the apparatus is newly fitted up; and the cambric framework must be refitted with the same material. The instruments can at any time be refitted by the makers at a small charge, and their absolute perfection of operation will be thus guaranteed.

The accompanying engraving represents the method of using the apparatus at the bedside. The patient, in ordinary labour, is for greatest part of the time preserved in a conscious state, but *without pain;* and is able to apply the instrument herself whenever necessary for her relief. For a surgical operation the elastic tube may be dispensed with. It is recommended by Mr. Ellis that a period of from ten to fifteen minutes should be occupied before *complete* insensibility is arrived at. But this time can be reduced to seven or eight minutes, or even less, according to the proportion of chloroform given with the other vapours. Commonly there is very little nausea or vomiting, if any, on recovery of consciousness, but this chiefly depends on the amount of chloroform given with the other vapours. With equal proportions of the three fluids scarcely any vomiting will happen.

The fluids employed by Mr. Ellis have been specially prepared with great care by Messrs. Savory & Moore, of New Bond Street. They consist of:—1. "Anæsthetic Alcohol," of sp. gr. 800, slightly tinged and rendered agreeably aromatic. 2. "Anæsthetic Ether," sp. gr. 720, also slightly tinged (of a golden colour) to distinguish it from the alcohol and chloroform. 3. Pure Chloroform, of sp. gr. 1,495. These fluids are consumed in the inhaler in almost equal proportions, but in such extremely small quantities, that the apparatus will soon repay its cost in the extraordinary

economy which it effects. Fuller details as to the principles of this new and valuable method of inducing insensibility to pain will be found on consulting the work from which some extracts have here been given.

Messrs. Savigny, in conclusion, beg to inform the Medical Profession that theirs is the only firm to whom Mr. Ellis has entrusted the instrumental part of his new anæsthetic system, and that their apparatus has been entirely manufactured from his own designs furnished to them.

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